Space Weather Technical Forecast

Issued on Saturday, 31 August 2024 at 12:07 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: M-flares expected, slight chance of X-flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Moderate with the peak flare M3.8 at 30/1220 UTC from AR3806 in the southeast. There are now thirteen sunspot regions on the disc, with two new regions appearing on the east limb. The largest region is currently AR3806 in the southeast, which has seen the ongoing emergence of small peripheral spots along with increasing penumbral extent, perhaps partly due to more detail becoming apparent as the region moves towards a clearer viewing angle. AR3807 near south centre disc continues to mature into a simple bipolar structure after its rapid growth yesterday. The regions emerging over the limb are not yet fully visible, so the analysis will change, but one of them may be ex-AR3780 which was large and complex on the previous rotation. All other regions are relatively simple and stable at the present time.

A filament eruption around 30/2330 UTC is currently being assessed for any Earth directed component. Otherwise, no Earth directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar winds, as measured by ACE at L1, showed waning CME and/or weak fast wind influence. Wind speeds varied from 330-420km/s, with density near or below average. The Interplanetary Magnetic Field, Bt, was initially moderate at 14nT or below, gradually and erratically easing to become weak to moderate between 6-9 nT. The north-south component, Bz, was moderately negative for much of the period, switching to become weakly positive at 31/0550 UTC. Phi angle was mostly positive (away from the Sun). Geomagnetic activity was Active to G1/Minor Storm (Kp 4-5) for most of the period, dropping to become Quiet (Kp 2) after 31/0900 UTC.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background levels. The 24-hour fluence was below the Active threshold, with 1.12e6 integrated pfu observed at 31/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is expected with a slight chance of isolated X-flares. The main flare risk is currently from AR3806 or perhaps the new region(s) on the east limb.

Solar Wind /Geomagnetic Activity: There are no Earth-directed CMEs currently expected. The recent enhancement is gradually easing, but further minor geomagnetic activity is possible on Day 1 (31 Aug). The next enhancement is expected on Days 2 or 3 (01-02 Sep) from a narrow negative polarity central disc coronal hole. A significant enhancement is unlikely, however. Mainly Quiet to Unsettled activity is expected, with Active intervals possible on Day 1 under weak fast wind or transient influence, then again on Days 2 or 3 with further fast wind enhancement possible.

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at background levels, with only a very slight chance of reaching the S1/Minor Radiation Storm level. High energy electron flux is expected to remain at background levels, perhaps reaching moderate at times during diurnal maximum. The associated 24-hour fluence is expected to persist below Active.

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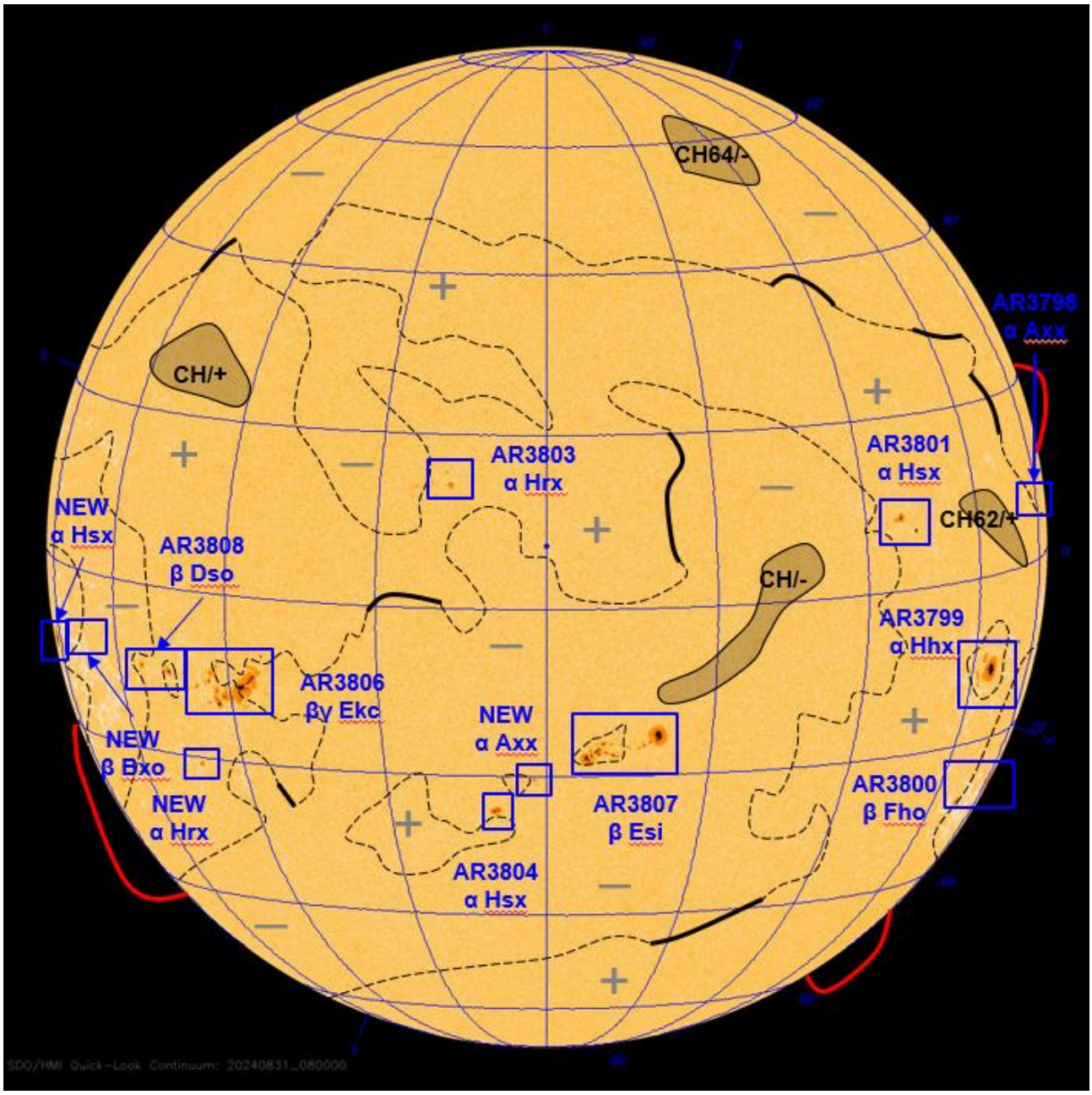
Figure 1. Solar Analysis Valid 31/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A filament eruption around 30/2330 UTC is currently being assessed for any Earth directed component. Otherwise, there are no Earth-directed CMEs currently expected.

The recent enhancement was either due to a weak fast wind from CH62/+ or a transient. Solar winds are at background speeds, with the magnetic field gradually easing, and it has also recently turned northward. Should it turn southward again, further minor geomagnetic activity is possible. The next enhancement is expected on Days 2 or 3 (01-02 Sep) from the narrow negative polarity central disc coronal hole. Any notable enhancement is low confidence, due to its small size, lack of persistence and unfavoured polarity for the time of year. MOSWOC Enlil is also thought to be overestimating an enhancement on Day 3, suggesting a strong and broad coronal hole fast wind connection that is not expected.

Mainly Quiet to Unsettled activity is expected, with Active intervals possible on Day 1 under weak fast wind or transient influence, then again on Days 2 or 3 with further fast wind enhancement possible.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	5	5	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No Earth directed CMEs are currently expected.

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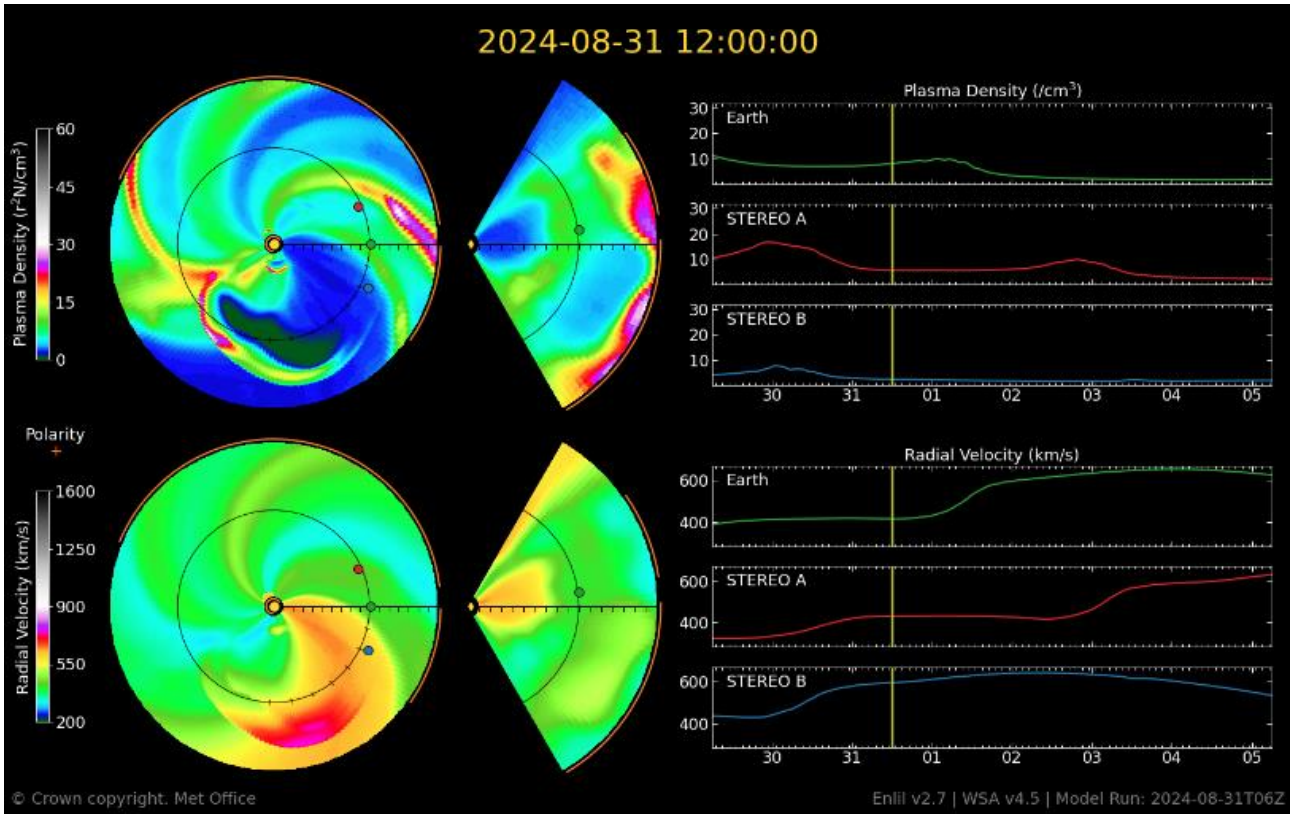
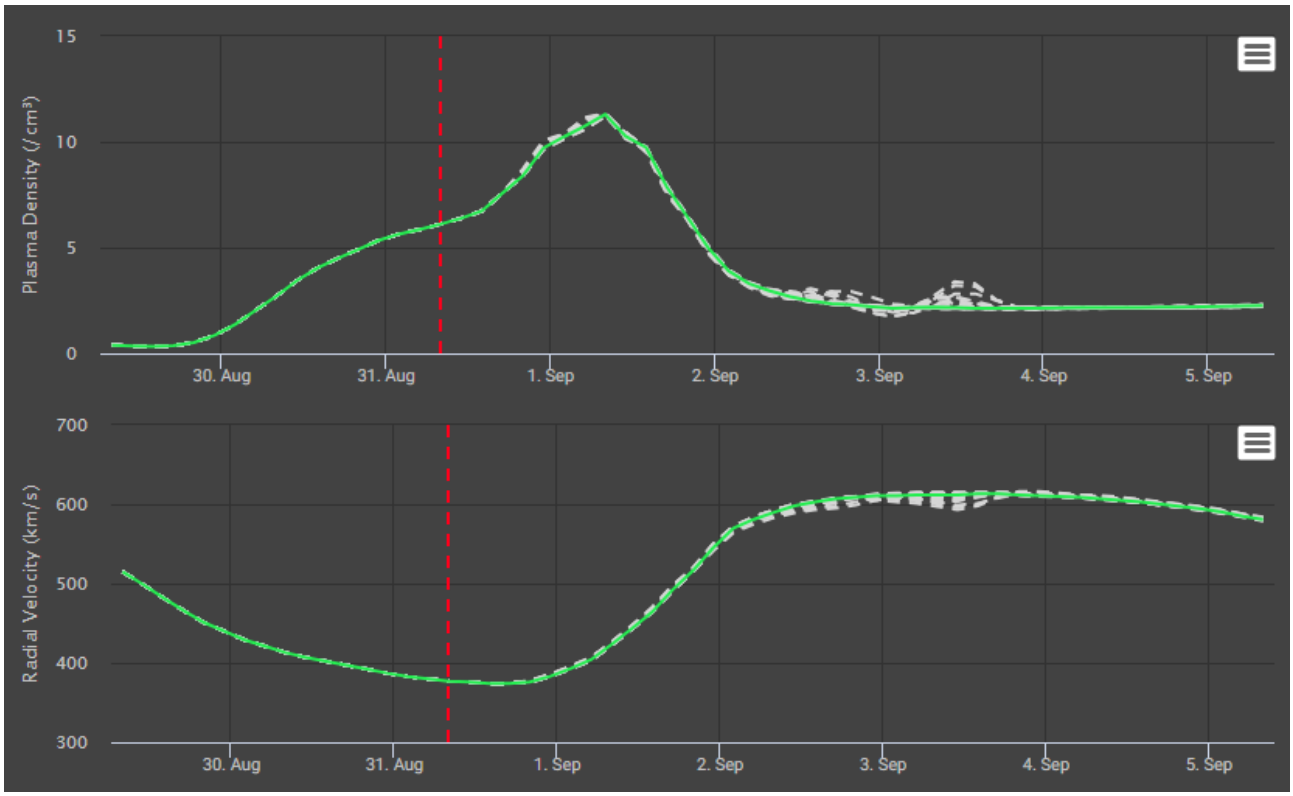
Figure 2: MOSWOC Enlil and ensemble, with no Earth directed CMEs currently modelled. Enlil is suggesting a strong fast wind on 02 September, which is considered to be overdone.





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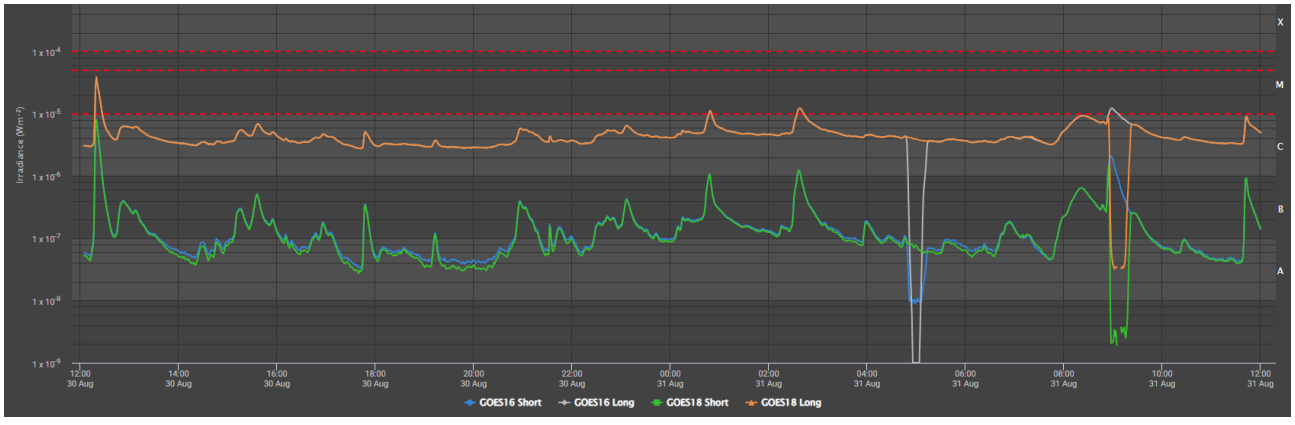
Radio Blackouts - X-Ray Flares:
There are now thirteen sunspot regions on the disc, with two new regions appearing on the east limb. The largest region is currently AR3806 in the southeast, which has seen the ongoing emergence of small peripheral spots along with increasing penumbral extent, perhaps partly due to more detail becoming apparent as the region moves towards a clearer viewing angle. This is a magnetically complex region, set within a broad area of plage and with potential for further growth. AR3807 near south centre disc continues to mature into a simple bipolar structure after its rapid growth yesterday. The regions emerging over the limb are not yet fully visible, so the analysis will change, but looping in SDO imagery suggests one of them has the potential to be a strong region and may be ex-AR3780 which was large and complex on the previous rotation. All other regions are relatively simple and stable at the present time.

Further Moderate activity is expected, with a slight chance of rising to High. Although there are three regions rotating off the disc in the coming days, if the new region on the east limb is ex-AR3780 then this may well balance any losses - or even raise the probabilities a little. However, we need to wait for a clearer view before this can be properly assessed.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	75	75	75	75
Very Active	R3 to R5 X Class	No	15	15	15	15

Figure 3: X-ray flux at GOES16 and 18, with four M-class flares in the last 24 hours.



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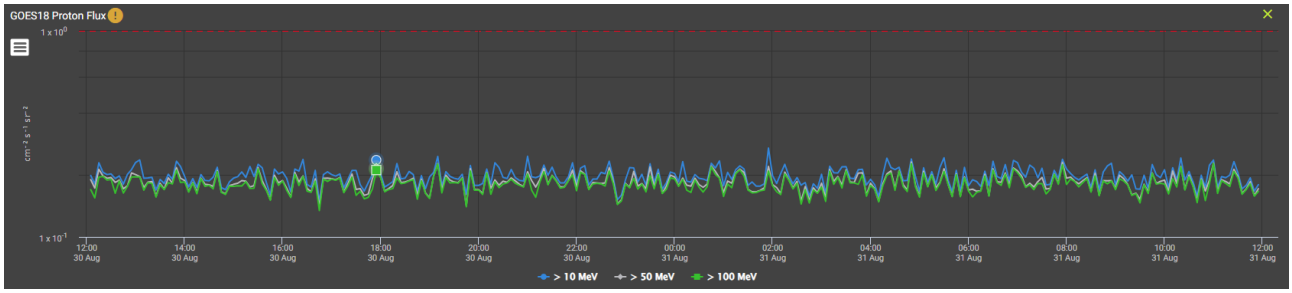
Solar Radiation Storms - (High Energy Protons):
High energy proton flux, as observed by GOES-18, is likely to persist at background levels with a slight chance of rising in response to any notable flares. While there are a few sunspot regions on the western disc, which is the better connected region of the Sun to give the potential for proton flux rises at GEO, these are generally fairly simple magnetically. The risk rises a little by Day 4 (03 Sep) as AR3806 crosses into the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Proton flux at GOES18, which is at background levels.



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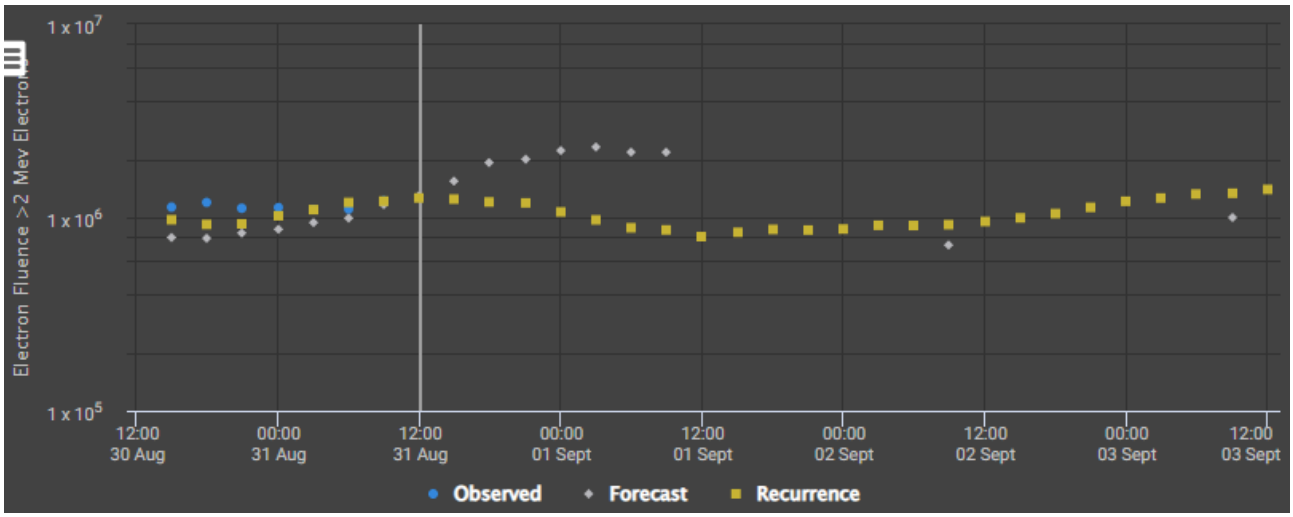
High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 is currently at background levels. Recent enhancements have given some geomagnetic activity but little in the way of wind speed increases. Whilst there is the potential for increased electron counts at lower orbits, this is considered unlikely to be significant. Periods of moderate flux are possible during diurnal maximum over the coming days.

Despite the potential for any increased flux, the associated 24 hour Fluence is expected to remain below the Active (1e8 integrated pfu) threshold throughout, although a slight rising trend is likely. MOSWOC REFM is providing good guidance for staying below this level, but likely underestimating any potential rising trend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM, showing a below Active forecast through the next three days, which is accepted.



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